

CROTON HYDROELECTRIC PLANT, DAM
Croton Dam Road, at the Muskegon River
Croton vicinity
Newaygo County
Michigan

HAER NO. MI-81-A

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

HISTORIC AMERICAN ENGINEERING RECORD

CROTON HYDROELECTRIC PLANT, DAM

HAER No. MI-81-A

HAER
MICH
62-CROTON,
1A -

Location: Croton Dam Road, at the Muskegon River,
Croton Vicinity, Newaygo County, Michigan

UTM: 16.608220.4810000

Quad: Croton, MI, 1:24,000

Dates of
Construction:

1906-1908

Engineer:

William G. Fargo

Present Owner:

Consumers Power Company, 212 West
Michigan Avenue, Jackson, Michigan 49201

Present Use:

Dam for hydroelectric generating plant

Significance:

The earth embankment dam at the Croton Hydroelectric Plant is an innovative design feature of this complex designed by William G. Fargo, a Jackson, Michigan civil engineer who specialized in designing small and mid-sized hydroelectric plants in the Midwest in the early Twentieth Century. Fargo was a pioneer in the construction of earth embankment dams on foundations of soft soils, using hydraulic sluicing methods. This dam is one of the earliest examples of the use of this technique east of the Mississippi River.

Project
Information:

This documentation is the result of a May 9, 1994 consultation meeting between the Consumers Power Company (CPCo) and the State Historic Preservation Office (SHPO). This meeting took place in response to CPCo's desire to rehabilitate the plant's spillway. As a result of the meeting, CPCo and the SHPO agreed to the recordation of the entire Croton Hydroelectric plant in accordance with Historic American Engineering guidelines. The documentation was completed in 1994 by Dr. Charles K. Hyde, Wayne State University, under contract to CPCo.

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HISTORY

The Croton Hydroelectric Plant powerhouse and spillway followed conventional contemporary engineering designs. However, in building the earth embankment dam, some 370 feet long and containing 104,000 cubic yards, Fargo used hydraulic sluicing to move the material from a nearby hill. This was one of earliest examples of this technique used on a large scale east of the Mississippi River. He also used this method to construct a fill of 20,000 cubic yards for a highway bridge crossing the Muskegon River immediately downstream from the dam. In the 1909 edition of the standard textbook on dam design, James Dix Schuyler disputed Fargo's priority, claiming instead that he (Schuyler) had published a paper in 1907 which encouraged Fargo to try hydraulic sluicing. Since Fargo had already used the method in 1906 at Lyons on the Grand River, Schuyler's claim is not convincing.¹

William Fargo constructed the dam using hydraulic excavation techniques between 25 June and 3 September 1907. The dam was built after the powerhouse and spillway sections had been completed. Fargo built a pumping plant at the river, using a total of seven rotary pumps, all driven by electric motors, to move water up a ten-inch pipeline to a bluff about 110 feet above the Muskegon River. At the bluff, Fargo reduced the line to four inches and fed the water into nozzles by means of four-inch rubber hoses. The water pressure, about 80 pounds/square inch at the nozzles, broke up the soil and the resulting mixture of water and soil was diverted into sheet iron troughs which extended about 850 feet at grades of 6-8 percent to the point on the embankment where the material was deposited.

The embankment was filled in sections to permit the water to drain off slowly and compact the fill. During the build-up of the embankment, the Muskegon River was diverted through the powerhouse raceways and through open gates in the spillway section. The chief advantage of the hydraulic sluicing method was its cost. The total cost of constructing the embankment, including depreciation of equipment, was only \$7,076 or about 7 cents per cubic yard of material moved. The fill Fargo built for the highway bridge approach cost roughly the same.²

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PHYSICAL DESCRIPTION

The earth embankment dam consists of two sections, one extending 270 to the east of the powerhouse and the second extending 100 feet to the west of the spillway. Both sections are between 40 and 60 feet high, varying with the depth of the riverbed. The earth embankments are approximately 800 feet wide at the base, with slopes of 3:1 on the upstream face and 2:1 on the downstream face, culminating in a flat crest 20 feet wide. Both segments have reinforced concrete corewalls, 1 foot thick and 43.50 feet high running the entire length of the embankments and located 15 feet north (upstream) of the crests. The corewalls rest on a sheet steel piling cutoff driven 36 feet below the riverbed, preventing water from undermining them.

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NOTES

¹James Dix Schuyler, Reservoirs for Irrigation, Water-Power, and Domestic Water Supply, With An Account of Various Types of Dams and the Methods, Plans and Cost of Their Construction, Second Edition (New York, 1908), p. 180 and Schuyler, "Recent Practice in Hydraulic-Fill Dam Construction," American Society of Civil Engineers, Transactions, Volume 58 (June 1907), pp. 196-277.

²William G. Fargo, "Hydraulic Excavation and Dam Building at the Croton and Lyons Dams in Michigan," Engineering News, Vol. 58, No. 17 (24 October 1907), pp. 429-431.

SOURCES OF INFORMATION

A. Engineering Drawings: The Consumers Power Company Engineering Department, 1945 West Parnall, Jackson, MI 49201, has over one hundred sheets of drawings produced by Fargo Engineering between 1906 and 1920. This collection of drawings is likely to be preserved well into the future.

B. Historic Views: Four historic views are in the office building at the Croton Hydroelectric Plant.

C. Bibliography

2. Secondary and Published Sources:

Fargo, William G., "Experience With Steel Sheet Piling in Hard Soils," Engineering News, Volume 57, No. 14 (4 April 1907), pp. 374-375.

Fargo, William G. "Hydraulic Excavation and Dam Building at the Croton and Lyons Dams in Michigan," Engineering News, Vol. 58, No. 17 (24 October 1907), pp. 429-431.

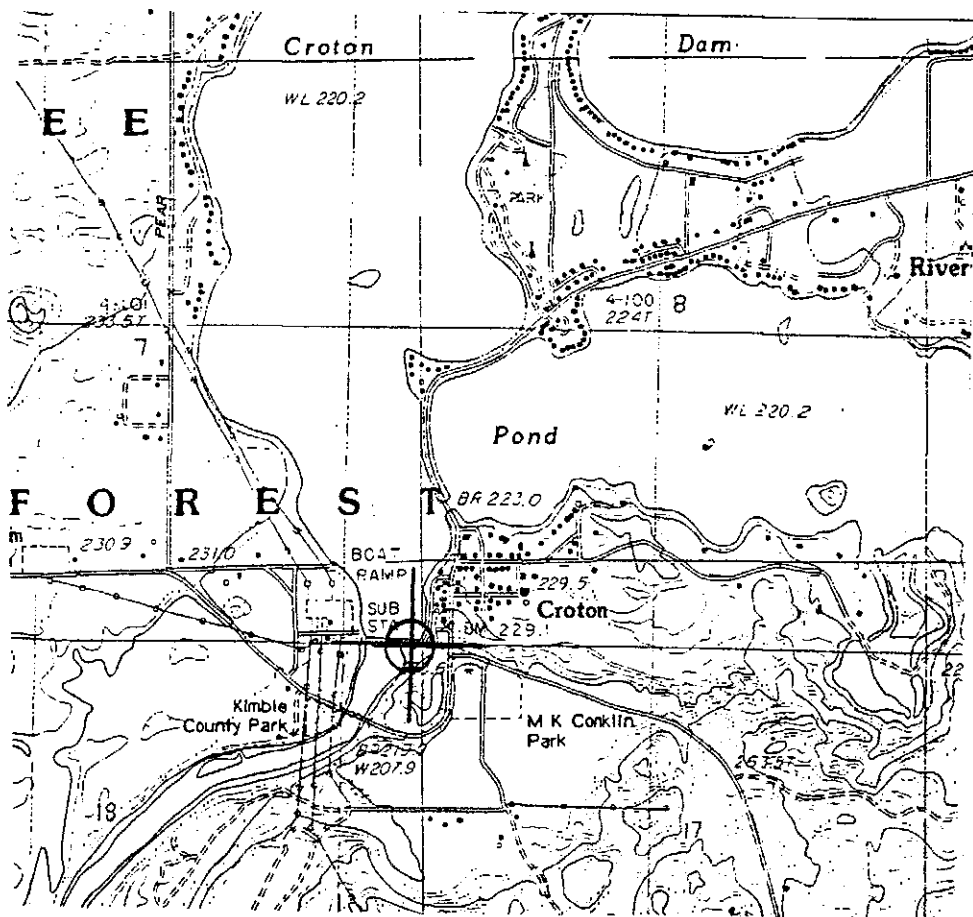
Schuyler, James Dix, "Recent Practice in Hydraulic-Fill Dam Construction," American Society of Civil Engineers, Transactions, Vol. 58 (June 1907), pp. 196-277.

Schuyler, James Dix. Reservoirs for Irrigation, Water-Power and Domestic Water Supply, With An Account of Various Types of Dams and the Methods, Plans and Cost of Their Construction. Second Edition. New York, 1909.

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CROTON, MICHIGAN QUADRANGLE, 1:24,000

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SITE PLAN

